Outreach Program to Develop And Implement Local Land Use Regulations to Protect the Remaining Undisturbed Natural Shoreland Buffers in the Town of Raymond, NH

The New Hampshire Estuaries Project

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Executive Summary

The purpose of the Town of Raymond Outreach Program to Develop and Implement Local Land Use Regulations to Protect the Remaining Undisturbed Natural Shoreland Buffers is create stronger and more detailed regulations to protect the sensitive areas around head water and 1st, 2nd, and 3rd order streams.

The sensitive land around the streams is vital in preserving wildlife habitats and stream water quality. It also maintains ecosystems and provides positive aesthetics for residents. This plan compares all of the Raymond town documents, master plan, zoning ordinance, and site plan regulations, with the State's Comprehensive Shoreland Protection Act. The state's shoreland protection act is very comprehensive and detailed and proves diagrams and restrictions for 4th order and higher streams or rivers in the state. However it can also be applied to low order streams. The state's regulations are far more in-depth than anything set forth by the Town of Raymond so it is beneficial for the town to model any new ordinances after them. Also included within this plan is a list of all the 1st, 2nd, and 3rd order streams in town. There are also maps in Appendix A that show the water sheds and stream through out Raymond.

Recommendations include adding or referencing the State's shoreland protection regulations to town documents with diagrams for clarity. Public outreach is favored in this plan and should be used to address new regulations and educate residents on why protecting stream shore buffers is important. The Public Outreach section of this plan provides examples.

This plan was created with the help of the New Hampshire Estuaries Project, University of New Hampshire Cooperative Extensions, the Town of Raymond Conservation Commission and the Southern New Hampshire Planning Commission.

Introduction

Project Steps, Goals and Objective

This plan aims to develop a new riparian buffer protection ordinance for the Town of Raymond's zoning ordinance. . The natural and vegetated areas found adjacent to shorelands along streams, rivers, ponds and great ponds are all considered riparian buffers. These natural buffers are extremely important to the proper function of the hydrologic cycle, which helps to maintain a clean water supply. Protecting these areas through land use regulations is one way that the impacts of development can be mitigated and the water quality of the adjacent water body can be protected. The new ordinance will identify low order streams to focus on, why they need to be protected, and new regulations for protection standards, set back standards, revitalization goals, and restricted uses. This plan will also provide public outreach on how to express to residents why buffers around low order streams are important and how they help in maintaining stream quality and the habitats that exist in and around them. Public education will also enforce the new set of standards that this plan aims to establish.

- The first step to accomplish these goals is to create maps that identify all of the 1st, 2nd, and 3rd order streams and all the hydrological features that exist through out Raymond. The next map that was made was a riparian buffer map and the undisturbed riparian buffers map. A map was also created to go along with the stream order chart. This map shows the different land use within a 100 foot buffer on all of the town's low order streams. Lastly an ortho photo map was created of the whole town of Raymond.

- Next, Raymond's zoning ordinance and master plan have been reviewed and compared with the State Shoreland Protection Act. This was done to find out how the town's regulations compared with those developed by the state, identify strengths and weaknesses. After reviewing all of Raymond's water protection and river protection standards it was evident that the town lacked any significant riparian buffer protection strategies. There are minimal protective standards in place to help keep the water ways in Raymond clean. Any regulations that exist are part of the conservation district and the regulations are all encompassing and not specific to low order streams, headwater or other sensitive waterways. Setback regulations in Raymond are more focused towards lot size and yardage and determine how far back a structure must be from wetlands. The State Shoreland Protection Act has a scoring system that evaluates the trees growing within a certain area. Each tree receives a certain amount of points depending on how big the circumference of the tree trunk is. This scoring system prevents healthy and mature trees from being removed. Also included in the State Shoreland Protection regulations are the reasoning behind the protection standards and rules. Reasoning needs to be included into the new Raymond ordinance so that it can go hand in hand with public outreach. Education and proving the reason for the importance of buffer protection will be an important part of the public outreach.

In developing the ordinance and accomplishing goals, the town worked with the National Resources Outreach Coalition (NROC), the Southern New Hampshire Planning Commission (SNHPC), and the New Hampshire Estuaries Project. The town also developed an Advisory/Technical Committee made up of members of the town planning boards and conservation commissions and a committed group of resident volunteers. The objective of the Advisory/Technical Committee is to develop a consistent model approach that could be adopted and applied within the town.

- The final step of the project is to develop a plan that creates new options for protecting the buffer areas around headwater and low orders streams, determine the best types of land use for the area, and identify land uses that could be potentially damaging to these sensitive water areas.

- The next steps after this include developing a public outreach plan to use towards working with residents of Raymond on protection strategies. It will also be used to educate residents on the purpose of this plan and the reasons for protecting the areas surrounding low order streams.

- Lastly the plan will attempt to reinforce New Hampshire state water protection policies that are currently in place but may or may not be enforced within the town.

Goals: To develop a strong riparian buffer protection plan for the Town of Raymond.

This plan should provide education and insight into how buffers help to protect low order streams and why they are important for the town to protect. Information in this plan should provide residents with enough background and detail on buffers so that they can identify these area in their own yard and take new actions in their daily activities and land use to protect them.

In addition to education this plan will develop a new suggested buffer ordinance to be used in addition to the town's current zoning ordinance. The new buffer ordinance will be a collaboration of state data, scientific evidence and resident input and preference. The goal of the new buffer ordinance is to provide protection for low order stream buffers that will protect them well into the future and safe guard them against improper land use and new growth.

The maps included in this plan should give clear insight into the town's low order streams, where they exist, and how the land around them is zoned and used.

Finally it is the main goal to have this plan and the proposed buffer ordinance reviewed and approved by the public and adopted by the town planning board.

Objective: To ensure that the needs of Raymond low order stream buffers are met in the sense that they are properly protected and regulated; and to involve residents to promote effectiveness of the new buffer ordinance.

Overview

Watersheds

The Town of Raymond is part of the Lamprey River and Exeter River watersheds. The Lamprey River watershed is a part of the northern part of Raymond while the Exeter River watershed makes up the southern part of town. The Lamprey River watershed is comprised of the northern 2/3 of Raymond while the Exeter River watershed is comprised of the southern 1/3 of Raymond. The two major lakes within Raymond are Governors Lake and Onway Lake. In total, Raymond's surface waters equal about 516 acres. The largest is Onway Lake which is 192 acres. Governors Lake is 52 acres. The water sheds, and the total amount of area they consist of is listed in Figure 1 below. Within these watersheds there are numerous small and large river ways, ponds, lakes, and wetlands. Amongst these water bodies and streams is the headwater and 1st, 2nd, and 3rd order streams that this plan is designed to protect. The Town of Raymond worked with the SNHPC to complete this plan so that it is customized to the Town of Raymond and is drafted so that it has recommendations and future plans that will successfully protect these sensitive waters ways.

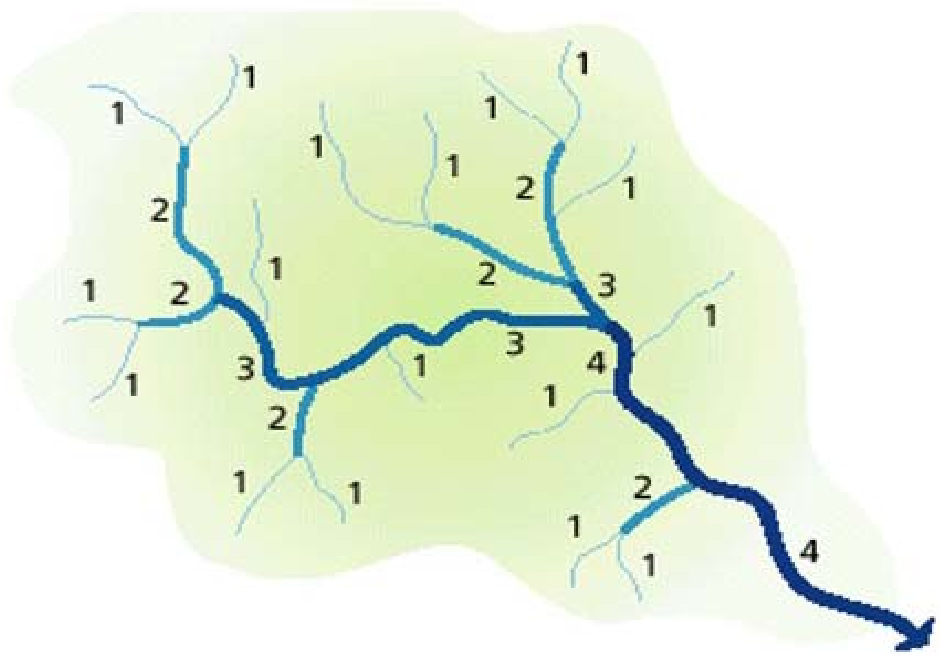
Watershed Areas in Acres

Watershed	**Area in Raymond**	**Total Area**
Lamprey River Basin		
Flint Hill	2626	2903
Pawtuckaway River	782	2439
Dudley Brook	2385	3054
Robinson Hill	1064	1348
Lamprey River "A"	181	403
North Branch "A"	117	372
North Branch "B"	379	1023
Lamprey River "B"	3001	3922
Onway Lake	1752	5457
Total	**12287**	**20921**
Exeter River Basin		
Fordway Brook	4723	6592
Little Rattlesnake Hill	1239	1317
Exeter River	623	898
Wason Brook	84	458

Total	**6669**	**9265**

Stream Order

Streams and rivers are categorized by order. A first order stream is coming out of the headwater or mouth of the stream. A 2nd order stream is formed when two 1st order streams come together. A 3rd order stream is when two 2nd order streams come together and so forth. This is further explained in the figure 2 below. This figure was taken from www.uwm.edu.



1st, 2nd, and 3rd order streams need to be protected because although they are small they feed into much larger streams and rivers that also lead into drinking water supplies and are also vital wildlife habitats. If one low order stream becomes heavily polluted those higher order streams that it feeds do as well.

Located in Appendix A is the hydrological features map for Raymond. It displays all of the streams found within the town and lists their stream order. The Town of Raymond has sixty seven recognized streams with an order number of 1, 2, or 3. The streams data used within this plan came from the 2007 New Hampshire Hydrography Data set created by NH GRANIT and the land use came from SNHPC and was based off of the 2005 aerial photography. The chart on the following page illustrates all of the recognized low order streams in Raymond and breaks down the different types of land cover that are found within a 100 foot buffer around each stream. The two types of land cover are urban and natural. The percentage amount of both types was calculated within the 100 foot buffer. Each stream is given an identification number and also shows its stream order number as well.

Stream Number	Stream Name	Length (ft)	Area (sq. ft)	Urban (sq ft)	Natural (sq ft)	% Urban	% Natural	Total	Stream Order
1		1,339	267,831	28,018	239,813	10	90	100	1
2		5,440	1,087,981	84,614	999,595	8	92	100	1
3		4,400	880,041	147,262	730,597	17	83	100	1
4	Dudley Brook	8,054	1,610,786	0	1,610,786	0	100	100	1
5		3,509	701,800	0	701,800	0	100	100	1
6		553	110,626	0	110,626	0	100	100	1
7		2,038	407,545	13,653	393,892	3	97	100	1
8		3,509	701,782	28,365	673,417	4	96	100	1
9		7,584	1,516,704	100,662	1,416,042	7	93	100	1
10		1,084	216,861	39,772	177,089	18	82	100	1
11		21,889	4,377,895	289,094	4,088,801	7	93	100	1
12		2,268	453,600	0	453,600	0	100	100	1
13		2,618	523,557	88,301	435,256	17	83	100	1
14		4,105	821,043	54,074	766,969	7	93	100	1
15		1,932	386,430	224,816	160,746	58	42	100	1
16		314	62,800	0	62,800	0	100	100	1
17		6,558	1,311,667	43,228	1,268,439	3	97	100	1
18		1,211	242,200	0	242,200	0	100	100	1
19		5,047	1,009,360	2,339	1,007,021	0	100	100	1
20		3,429	685,800	0	685,800	0	100	100	1
21		4,201	840,245	103,360	736,885	12	88	100	1
22	North Branch River	4,280	856,014	135,232	720,782	16	84	100	1
23		2,101	420,221	102,545	317,681	24	76	100	1
24		2,456	491,208	342,168	148,400	70	30	100	1
25		6,862	1,372,452	142,459	1,227,562	10	89	100	1
26		2,142	428,346	19,285	409,061	5	95	100	1
27		2,899	579,720	20,656	556,877	4	96	100	1
28		2,444	488,890	0	488,890	0	100	100	1
29		1,227	245,380	0	245,380	0	100	100	1
30		570	114,046	0	114,046	0	100	100	1
31		6,255	1,250,938	286,952	963,986	23	77	100	1
32		10,788	2,157,644	85,126	2,069,857	4	96	100	1
33		2,618	523,503	14,109	506,858	3	97	100	1
34		4,567	913,311	397,489	515,822	44	56	100	1
47		15,528	3,105,565	703,712	2,392,832	23	77	100	1
48		74	14,800	0	14,800	0	100	100	1
49		1,935	386,976	2,995	382,226	1	99	100	1
50	Fordway Brook	3,828	765,510	39,426	726,084	5	95	100	1
51		1,962	392,409	47,616	344,793	12	88	100	1
52		2,244	448,724	0	448,724	0	100	100	1
53		4,235	847,032	33,078	813,954	4	96	100	1
54		58	11,680	11,715	0	100	0	100	1
55		2,301	460,278	76,492	383,786	17	83	100	1
56		3,281	656,115	0	656,115	0	100	100	1
57		4,214	842,863	183,283	659,580	22	78	100	1

58		3,350	670,026	168,513	500,074	25	75	100	1
59		713	142,662	120,560	22,102	85	15	100	1
60		580	116,021	0	116,021	0	100	100	1
61		7,155	1,431,027	186,374	1,244,653	13	87	100	1
62		886	177,176	49,251	127,821	28	72	100	1
63		1,753	350,542	0	348,888	0	100	100	1
64		2,416	483,139	121,950	361,189	25	75	100	1
65		2,221	444,200	0	444,200	0	100	100	1
66		9,806	1,961,267	2,463	1,961,267	0	100	100	2
67		4,591	918,256	298,151	618,790	32	67	100	2
68		2,103	420,559	208,002	212,557	49	51	100	2
69		2,053	410,506	84,930	325,576	21	79	100	2
70		4,262	852,482	259,992	591,423	30	69	100	2
71		2,598	519,646	9,166	510,480	2	98	100	2
72		2,250	450,041	51,772	398,269	12	88	100	2
73		3,767	753,453	95,145	658,308	13	87	100	2
74	Dudley Brook	4,422	884,420	279,250	603,039	32	68	100	2
75		400	80,006	11,487	68,519	14	86	100	2
76		2,746	549,126	34,265	513,848	6	94	100	2
77		3,323	664,630	450,767	211,173	68	32	100	2
78		1,284	256,847	659	256,188	0	100	100	2
79		1,578	315,635	189,325	125,895	60	40	100	2
80		44	8,784	2,665	6,119	30	70	100	2
81	Fordway Brook	2,524	504,725	88,155	416,097	17	82	100	3
82		5,223	1,044,524	146,988	892,542	14	85	100	3
83	Fordway Brook	32,71 2	6,542,487	581,764	5,960,723	9	91	100	3
84		3,168	633,643	42,460	591,183	7	93	100	3
85		3,361	672,263	18,841	653,422	3	97	100	3
86		2,686	537,110	28,285	508,825	5	95	100	3

Multiple studies have been conducted by the United States Environmental Protection Agency (U.S. EPA) on the effectiveness of buffers and evidence that they reduce chemical contamination of water ways. The exert below was taken from “Riparian Buffer Width, Vegetative Cover; and Nitrogen Removal Effectiveness: A Review of Current Science and Regulations”, October 2005, U.S. EPA:

Synthesis of Published Reviews on Buffer Effectiveness

We found 14 comprehensive and regional reviews of riparian buffer literature, most of which contained generalizations and recommendations based on both peer-reviewed and non-peer-reviewed research. In general, riparian forest vegetation and wetlands have been demonstrated as effective nutrient filters, particularly those between ~10-50 m wide (Belt et al. 1992, Johnson and Ryba 1992, Castelle et al. 1994, Fennessy and Cronk 1997, Fischer and Fischenich 2000, Christensen 2000). Narrower riparian buffers (5-6 m) may still reduce subsurface nitrate flows by up to ~80% (Muscutt et al. 1993, Parkyn 2004). However, extensive experimental support for buffer zones <10 m, like those used extensively on many farms, is lacking (Hickey and Doran 2004). Furthermore, riparian buffer zones >30 m were recommended for fully effective subsurface nutrient reduction (Muscutt et al. 1993, Wenger 1999). According to Wenger and Fowler (2000), “The most effective buffers are at least 30 meters, or 100 feet, wide composed of native forest, and are applied to all streams, including very small ones.” The use of riparian buffers to filter nutrients from surface flow was not recommended by Barling and Moore (1994) because dissolved nitrate was not significantly reduced.

Groundwater flow paths, soil characteristics (i.e., moisture storage, hydraulic conductivity, roughness, and slope), seasonal, and climate may significantly impact the rate and magnitude of subsurface nitrate removal. Groundwater flow above shallow, impermeable soil layers maximizes water residence time and contact with plant roots and organic-rich soils, thereby increasing the potential for nitrate removal by plant uptake and microbial activity (Hill 1996, Christensen 2000). Considerably less nitrate removal per unit distance occurred where local or regional groundwater flowed at deeper depths or through organically-poor soil (Hill 1996). Where groundwater bypassed the root zone and surface soil layers, the retention of nitrogen was minimal (Lowrance et al. 1997).

Detailed Insight into the Peer-Reviewed Literature about Buffer Effectiveness

Vegetated buffers around wetlands

Wetland buffer zones were highly variable in their effectiveness, removing from 12-80% of surface water nitrogen (Yates and Sheridan 1983, Brüsch and Nilsson 1993). However, much faster nitrate reductions can occur in the groundwater of wetlands where, in some cases, >95% of nitrate can be removed within 1 m (Burns and Nguyen 2002). Brüsch and Nilsson (1993) documented temperature and seasonal components to nitrate reductions in surface runoff across a 15-25 m wide peat wetland. Average nitrate reduction was 73.7% in the summer, 12.2% during the first winter, but ~38% during the second winter season due to higher temperatures. Despite seasonal variance in mean surface runoff nitrate concentration of 15 to 50 ppm, nitrate concentration in an adjacent stream did not exceed 5 ppm throughout the study. Seasonal patterns, but with higher percentage of nitrate reduction (>90%), also were noted in a 200-m wide reed and alder wetland within a river channel scar (Fustec et al. 1991).

Wetland buffers on soils with limited organic matter (i.e., sand or gravel) tended to show lower capacity to remove nitrogen. Cooper (1990) found that, while subsurface nitrate removal from highly organic, saturated soils was ~90%, removal from within mineral colluvial soils was much less effective. Clausen et al. (2000) observed a 52-76% reduction in subsurface nitrate concentrations (95% of all nitrate loss) across a 5-m “poorly to very poorly drained alluvium wetland.” Hanson et al. (1994) and Vellidis et al. (2003) observed similar reductions in nitrate (59% and 78%, respectively) from sandy, forested wetlands (31 and 38 m wide, respectively). Under “severely suboptimal conditions” in forested wetlands (i.e., sparsely vegetated, poorly drained, bottomland soils), riparian buffer widths <100 m were estimated to be 90% efficient at removing nutrients from agricultural runoff. However, under less severe conditions, buffer widths of 40-80 m on poorly drained soils and 15-60 m on well-drained soils were estimated to remove most nutrient runoff passing through a forested wetland, riparian zone (Phillips 1989b).

Forested buffers

The attenuation of nitrogen from groundwater flow can be rapid in forested riparian buffer zones. Schoonover and Willard (2003) found that 10-m forested buffers reduced groundwater nitrate concentration by 61%. Another study found a buffer averaging 38-m wide reduced nitrate concentration by 78% and ammonium by 52% (Vellidis et al. 2003). Others have documented more than 85% nitrate removal within the first 5 m of a buffer and 90-99% removal within 10-50 m of a buffer (Jacobs and Gilliam 1985, Lowrance 1992, Cey et al. 1999). As with wetland riparian buffers, most of the N transformation (~75%) occurred within the subsurface flow (Peterjohn and Correll 1984, Osbourne and Kovacic 1993). Furthermore, mature forests were 2-5 times more effective than "managed" (i.e., clearcut or selectively thinned) forests (Lynch et al. 1985, Hubbard and Lowrance 1997). Kuusemets et al. (2001) estimated that 85% of total nitrogen was retained in a heavily polluted 51-m wide riparian buffer, whereas only 40% of total nitrogen was retained in a buffer 31 m wide. Riparian buffers 100 m and 200 m wide in North Carolina removed from 67%-100% of groundwater nitrate entering the stream (Spruill 2004).

Effectiveness of nitrogen removal in forested riparian zones can vary widely due to characteristics unrelated to width. Extreme nitrogen loading (Lowrance et al. 1997) and increased hydraulic conductivity of the soil (Pinay and Decamps 1988, Pinay et al. 1993, Sabater et al. 2003) decrease effectiveness of forested riparian buffer zones. In some cases, these conditions can result in a net increase in nitrate concentrations in the groundwater (Sabater et al. 2003, Groffman et al. 2003) and can double the necessary width of the riparian zone for effective nutrient removal (Kuusemets et al. 2001). Spruill (2000) observed no difference in deep, "old" (>20 yr) groundwater underneath riparian zones with and without forested 30-m buffers, but 65-70% nitrate removal in shallow, "young" (<20 yr) groundwater through "reduction or denitrification." Effects of buffer width and length were mixed in a New Zealand study of forested buffers. However, oldest, longest (longitudinal), and widest (lateral) buffers had the greatest total nitrogen reductions (Parkyn et al. 2003). Saturated conditions led to removal of all nitrate within the first 30 m of forested riparian buffers in France (Pinay and Decamps 1988).

Grasslands

Grassed buffers or filter strips used alone or in conjunction with woody vegetation also can be effective at removing nitrogen. A 7.1-m grass buffer removed 80% of the total nitrogen and 62% of nitrate. Addition of a 9.2-m woody buffer to the grass buffer (total 16.3 m) increased effectiveness by 20%, removing 94% of the total nitrogen and 85% of the nitrate in runoff. However, effectiveness of the buffers in this study was negatively related to intensity of rainfall events (Lee et al. 2003). Giant cane (*Arundinaria gigantea*) reduced nitrate levels 90% in the first 3.3 m of the buffer, and 99% over 10 m, an effectiveness promoted by saturated conditions from upwelling groundwater (Schoonover and Williard 2003). In a study of seven herbaceous and herbaceous/forested riparian buffers in Canada, 90% removal of nitrate occurred 15 to 37 m into the riparian buffer depending on soil types and depth of the confining layer (Vidon and Hill 2004). Conversion of a portion of a corn field (*Zea mays* L.) to a riparian buffer of fine leaf fescue (*Festuca* spp.) decreased overland flow concentrations of total Kjeldahl nitrogen (TKN) by 70% and nitrate by 83% over the control and reduced nitrate concentrations in groundwater by 35%. Most (52%) of the nitrate decrease occurred within a 2.5-m wetland adjacent to the stream (Clausen et al. 2000).

In an Italian study, a 6-m wide grass/forest buffer (5-m grass + 1-m trees) reduced groundwater nitrate by >90% from maximum concentrations of ~25-28 ppm ($\bar{x}$ = 6.2) under the application field to a level always ≤2 ppm ($\bar{x}$ = 0.6) in groundwater (Borin and Bigon 2002). Grass buffers <5 m wide were ineffective in removing total nitrogen from surface runoff; those <10 m, but >5 m, wide were found to be 29-65% effective (Magette et al. 1989, Schmitt et al. 1999). Addition of a "forested" component to the grass buffer did not increase effectiveness (Schmitt et al. 1999). Grass filter strips 4.6 and 9.1 m wide reduced surface nitrate runoff from no-till cornfields by 27 and 57%, respectively. However, similar filter strips installed below animal feedlots were completely ineffective, yielding net gains in surface runoff nitrate concentrations (Dillaha et al. 1988, 1989).

According to studies done by NH DES shoreland buffers prevent sediment from flowing into streams. Sediments such as natural clay, sand, and run off from constructions sites may not always pollute a stream by contaminating it with chemicals but they still destroy the stream. For example lakes and ponds that fill with sediment encourage weed growth, making for poor boating and water craft conditions. Some sediment can contain nutrients that boost algae and weeds as well. This would lower the value of the homes surrounding the lake because it would not be as valuable a water body for motorized recreation. Overall cloudy lakes full of sediment do not attract people to swim in them, which ultimately could affect tourism to particular areas. Sediment also makes for poor fishing because it clouds the water and makes it difficult for certain fish, who rely on sight, to feed. It also smothers gravel beds that some fish use to lay their eggs. The shading that some buffers provide helps to reduce certain species of algae such as blue-green algae which thrives in direct sunlight. These types of algae threaten a water body's ecosystem. The undisturbed vegetated areas found along low order streams serve to protect the fragile natural ecosystems that exist and maintain a high level of water quality. When rainfall or surface water runoff percolates through undisturbed natural and vegetated areas prior to reaching a stream or other body of water, both particulate and chemical filtration occurs. These functions cannot occur when filtration is prevented due to development that creates impervious surfaces

One major incentive to residents is that restoring and maintaining buffers costs tax payers very little money. They reduce floodplains which could minimize flooding to residential areas and reduce property and yard damage. Since some buffers act as retaining areas for stormwater they also serve to filter it before it seeps into the ground and drinking water. And since they reduce sedimentation from flowing into streets it protects drainage systems and helps prevent them from clogging.

Activities and Methods

The first step in protection is to conduct an inventory to determine where development exists within the watersheds. This will give insight into what land protection measures are needed to prevent any future disturbance to the buffer area. The Raymond inventory was conducted with Geographic Information Systems (GIS) mapping tools to create the map below that features the undisturbed and intact buffers along the town's water ways.

It also provides an indication of the location and amount of the natural undisturbed buffers which remain within the community and areas that the buffers may need to be reestablished.

The Lamprey River Advisory Council is a committee of representatives that work to develop and implement successful river management under the New Hampshire State River Management and Protection Program. They also work with local communities to establish management plans to preserve the Lamprey River. This advisory council is a significant means of protection and resources.

Buffers benefit humans just as much as they benefit the water, and the wildlife that live there. Well established buffers can provide shade if there are larger trees and shrubs within the buffer. For those living along larger waterways and lakes, they can provide privacy and act as a noise buffer from people participating in water sports. This is generally not a problem for low order streams but there could be non motorized water craft use, such as kayaking and canoeing, in a 3rd order stream. A vegetated buffer would prevent visual intrusion if a stream ran through someone's yard and the buffer would also discourage people from traveling up onto banks and tearing up soft top soil and sensitive plant life. Some plants that grow in very wet soils are easily uprooted, and with disappearing root system the soils would easily erode during heavy rain and from natural currents. This erosion can change the flow of a stream or cause unnecessary damming. The plants along a stream help keep the soil intact, and in the case of residents, it keeps their land from being cut away by the streams.

In order for this plan to be successful residents must understand why they need to work with the ordinance to protect the low order streams in town.

Public Outreach and Education

Public outreach is the methods and strategies used by a group to get messages and information out to the general public. Public outreach can be accomplished through several different media's such as public meetings, education programs, visual displays, websites, and press releases. Overall, public out reach serves to let the public know what is going on within a group and offers them the information that they need. In this case public outreach would enforce the new buffer regulations. The outreach should provide back education on why low order streams are important and valuable to residents and how they affect the big picture of larger rivers and even drinking water. People will not practice the new standards if they don't understand why the protection regulations are there and how they can help residents on a personal level. The value of the new protection standards needs to hit close to home for residents and they must understand the numerous benefits of practicing them.

Education must also include ways to put the new standards into practice. To get information out to the public possible outreach activities could include:

- Educational presentations which would be open to the public. Presentations could be given on stream order, sensitive species found in Raymond's water systems, types of vegetation found in buffers, and how protecting buffers helps streams and everyone around them. These presentations could be offered by NH DES, SNHPC, or a Raymond Town official.
- Educational articles in the local newspaper or other public flyers and regular town circulars.
- Educational pamphlets that could be displayed at public locations like the library, town offices, high school, planning offices. The pamphlets would be available to anyone who would want to take them.
- Educational signs or posters could be professionally made and posted along trails or water access areas so those in the area will be able to understand why they should tread carefully. It will also give a visual so people can identify first hand the buffers around them.
- Information on new buffer protection regulations and ordinances could be piggybacked onto appropriate presentations that take place in town.
- A link from the Raymond official homepage could provide a copy of this plan and suggestions to maintaining buffers. The same link could be attached to the SNHPC and NH DES websites as well.
- Badly eroded shorelines on public lands could be restored as part of a Boy Scout, Girl Scout, 4-H or similar program community service project.

- Information of buffers could also be printed in the Raymond Recreation Department quarterly newsletter.

Public outreach should be done in a manner that is convenient to residents; i.e. after normal working hours or on weekends, during good weather conditions, and at locations that are convenient to access and park at. The New Hampshire Estuaries Project recommends doing public outreach activities during the summer months. Outreach activities should be flexible and allow for public input and question and answer sessions.

Evaluation of Existing Regulations

State Comprehensive Shoreland Protection Act

The State's Comprehensive Shoreland Protection Act (CSPA) currently applies to approximately 17,096 feet of the Lamprey River shoreline which is protected as a 4th order stream under the State's stream ranking protocol. The length of the river subject to these regulations is identified in Hydrological Features. These regulations currently require a 150 foot wide natural woodland buffer along both sides of the river.

The CSPA has goals that are specific to streams and recognizes how fragile and important they are. The CSPA has a purpose, minimum standards required, consistency required, definitions, enforcement by commissioner; duties; woodland buffers, permit references, approval information, minimum shoreland protection standards, structure information, rule making and penalties.

The purpose of the CSPA recognizes shorelands and how they are essential to maintaining public waters. It states general protection necessities and basic reasoning behind protection. The minimum standards that the CSPA are required to protect include wildlife, prevent and control water pollution, conserve shoreland cover, protect public use, and allow for economic development in proximity to streams. It will be important for Raymond's own standards to emphasize to the public that the buffers will still allow for public access to waters and promote new developments that can be built unobtrusively near the buffer areas.

Raymond's Local Regulations

The Town of Raymond's existing regulations are found in the town's zoning ordinance. They are located primarily in Article III and Article IV. The Town of Raymond's existing regulations are found under the Groundwater Conservation District (Article III) in Section 3.340 and the Groundwater Protection District (Article III) in Section 3.341, in the Zoning Ordinance.

The purpose of the Groundwater Conservation District is to maintain and protect the health, safety, and general welfare of the potential groundwater supply areas from being polluted as well as to protect groundwater fed surface waters. This is accomplished by regulating land uses that could potentially contaminate drinking wells and aquifers that are or could someday be public water supplies.

The Groundwater Protection District is an overlay district that is superimposed over the existing underlying zoning. Within the boundary of the district are the Town's wellhead protection areas, these areas are identified in the May, 1992 Wellhead Protection Program.

The Groundwater Conservation District performance standards require a storm water management plan for any use that renders more than 20% impervious areas. It is required that all animal waste, compost and fertilizers be stored in accordance with the Best Management Practices for Agriculture in New Hampshire Department of Agriculture, Markets, and Food. All regulated substances over 5 gallons must be stored in product-tight containers and stored against unauthorized entry, protected from the elements, and labeled.

The groundwater conservation district ordinance also lists permitted uses. Permitted uses or any uses which are granted in under special acceptance must comply with the regulated substance and management performance standards. Prohibited uses within the groundwater protection district include, but are not limited to: hazardous waste disposal facilities, solid waste landfills, outdoor storage of road salt or similar de-icing chemicals, junkyards, snow dumps, and operation of wastewater or other septage lagoon. Conditional use permits can be granted if certain standards with storage and handling are adequately met.

The groundwater conservation district regulations are important to this buffer plan because it requires strict safety standards that must be met by each site so that chemicals and other pollutants are not released into the ground or water ways. This avoids polluting valuable drinking water sources. These protective regulations would benefit all water bodies including head water and the 1^{st}, 2^{nd}, and 3^{rd} order streams that this plan strives to benefit and protect.

New shoreland protection approaches for Raymond will improve and enhance existing regulations within Raymond by improving knowledge of the Comprehensive Shoreland Protection Act and amending current regulations with higher protective standards that are in compliance with the State Shoreland Protection Act. These new protective standards will preserve land around low order streams and set rules so that development does not hinder the protective qualities that untouched stream buffers have. Zoning amendments will include mowing restrictions, building set back alterations, land use restrictions within the buffer areas and educating the public and town officials.

The town's current Shoreland Protection Area applies mostly to larger rivers within the town and large bodies of water and is defined as part of the zoning ordinance's "Conservation District". It is also restricted to water ways that have standing water for half the year. The protection areas need to be focused around low order streams as well as the larger ones. As previously stated, low order streams are a vital part of protecting larger waterways from pollution. If the lower order streams remain unpolluted, the larger water ways, for the most part, will too. First Raymond's Shoreland Protection area must be compared with the State Shoreland Protection Act.

Currently in Raymond's 2007 Zoning Ordinance the Shoreland Protection Area is

> "any area of land within seventy-five (75) feet of the seasonal high water mark of the Lamprey River, the Exeter River, the Branch River, Dudley Brook, Pawtucket River, Fordway Brook, Governor's Lake, Onway Lake, Norton Pond and other perennial major brooks, streams or ponds existing within the Town of Raymond and also includes land within fifty (50) feet of the high water mark of any brook, stream or pond having flowing or standing water for six (6) months of the year". (2007 Zoning Ordinance)

The town's Shoreland Protection lacks any regulations that focus around low order streams. It only lists the large waterways within town. It lists setback distances for structures but there are no limitations to what can be within these setback areas. This means that the grass or plants in the area can be mowed down or fertilized and is not required to be left in their natural state. The regulations also do not have any land use restrictions regarding storage of any types of chemicals or other hazards that could pollute nearby waterways. In order for Raymond's low order streams and headwater to be adequately protected these types of standards and details should be included in the new amended ordinance. The new ordinance would minimize the negative human impacts around the low order streams but still be accommodating for smart growth.

The State's Comprehensive Shoreland Protection Act will be a guideline for improving Raymond's ordinances. Shoreland protection standards, buffer maintenance, development, and impervious surface requirements will be used as starting points to ensure that all the aspects of a quality shoreland buffers plan are covered. In addition to using the State's shoreland protection standards and developing more extensive shoreland buffer regulations for Raymond, public education and out reach will also be a priority within this plan.

Possible Shoreland Protection Approaches

New Town Shoreland Protection Ordinance Regulations
Raymond's Shoreland Protection Area and any standards that protect the stated 75 foot buffer are part of the all encompassing Conservation District. The Conservation District does contain lists of permitted and prohibited uses but protection standards for water way buffer areas do not exist. The first step to improving this is to include all lower order streams within the town's shoreland protection area. The lower order streams should have their own set of protection and management standards. The lower order streams will, as stated earlier, include 1st, 2nd, and 3rd order streams and headwater. All of the low order streams within in Raymond can be identified on the hydrological features map in Appendix A. The more narrow the stream appears on the map the lower its stream order number is.

The vegetated buffers around streams provide benefits that help keep the actual shore land intact and protected. The root system of the natural plant growth in these areas act as anchors to the soil and during heavy rainfall prevent the soil and other sediments from running into the streams and altering flow patterns. When these types of materials run off into waterways they alter natural habitats as well, negatively impacting eco systems that in turn help maintain healthy stream life. Natural vegetation buffers are natural stormwater treatment systems. Runoff from paved surfaces contains pollutants; natural vegetation can help to purify this run off before it reaches the water.

This photo is a good example of a vegetated buffer around the Merrimack River.

This photo was taken in Centre County, Pennsylvania and is an example of a poor riparian buffer. In this photo there is no livestock fencing that is preventing livestock from accessing the banks of this river. As a result they have torn up all the soil and eaten and trampled down any vegetation. A small live stock fence or a designated area for their water access could have prevented this.

The town should adopt the same or similar standards set by the State for set back regulations on streams. Below are the State standards for setbacks. They have been put into affect in April of 2008. The standards below are accompanied by a graphic that illustrates the breakdown of the measurements used and where each area is in relation to the stream. The buffer area closet to the stream is the waterfront buffer, which extends from the edge of the stream to 50 yards back. Ground cover can not be removed from this area and only foot paths to the water are permitted. The next buffer area, also referred to as the Natural Woodland Buffer, is required to remain exclusive of impervious surfaces but does allow for some ground cover removal when necessary. The outer edge of the buffer is the protected shoreland area; this area permits some impervious surfaces but

250 feet from Reference Line—THE PROTECTED SHORELAND:

Impervious Surface Area Allowance. Twenty percent of the area within the protected shoreland may be impervious surface. This may be increased up to 30 percent if there are 50 points of tree coverage in each 50 foot x 50 foot grid segment in the waterfront buffer (WB), and a storm water management plan is submitted and approved by DES.

Other Restrictions:

- No establishment/expansion of salt storage yards, auto junk yards, solid waste and hazardous waste facilities.
- All new lots, including those in excess of 5 acres are subject to subdivision approval by DES.
- Setback requirements for all new septic systems are determined by soil characteristics.
  - 75 feet for rivers and areas where the there is no restrictive layer within 18 inches and where the soil down gradient is not porous sand and gravel (perc>2 min.).
  - 100 feet for soils with a restrictive layer within 18 inches of the natural soil surface.
  - 125 feet where the soil down gradient of the leachfield is porous sand and gravel (perc rate equal to or faster than 2min/in.).
- Minimum lot size in areas dependent on septic systems determined by soil type.
- Alteration of Terrain Permit standards reduced from 100,000 square feet to 50,000 square feet.
- For *new* lots with on-site septic, the number of dwelling units per lot shall not exceed 1 unit per 150 feet of shoreland frontage.

150 feet from Reference Line—NATURAL WOODLAND BUFFER (NWB) RESTRICTIONS:

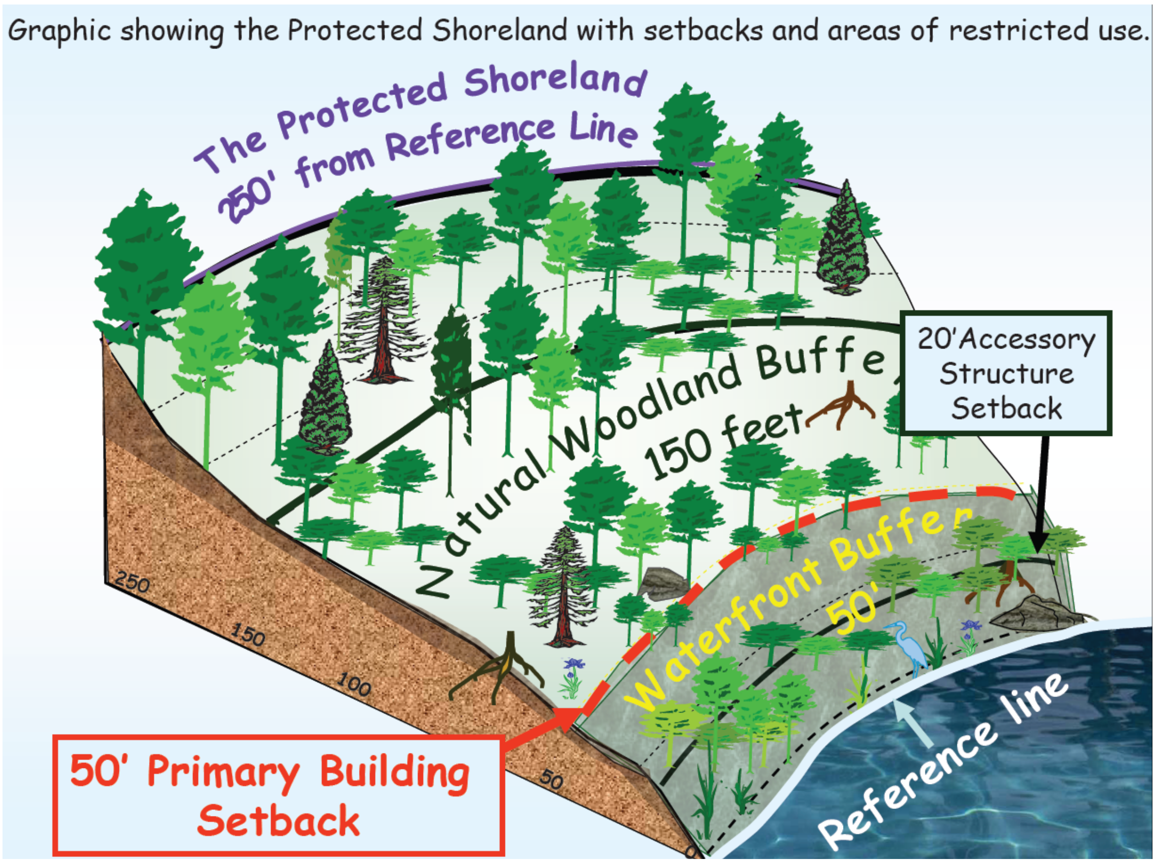
- For lots that contain ½ acre or more within the NWB, between 50 feet and 150 feet of the reference line, the vegetation within at least 50 percent of the area, exclusive of impervious surfaces, shall be maintained in an unaltered state.
- For lots that contain less than ½ acre within the NWB, between 50 feet and 150 feet of the reference line, the vegetation within at least 25 percent of the area shall be maintained in an unaltered state.

50 feet from Reference Line—WATERFRONT BUFFER and PRIMARY BUILDING SETBACK:

- Effective April 1, 2008, all primary structures must be set back at least 50 feet from the reference line. Towns may maintain or enact their own setback only if it is greater than 50 feet.
- Within 50 feet, a waterfront buffer must be maintained. Within the waterfront buffer, tree coverage is managed with a 50-foot x 50-foot grid and points system. Tree coverage must total 50 points in each grid. Trees and saplings may be cut as long as the sum of the scores for the remaining trees and saplings in the grid segment is at least 50 points.
- No natural ground cover shall be removed except for a footpath to the water that does not exceed 6 feet in width and does not concentrate stormwater or contribute to erosion.
- Natural ground cover, including the duff layer, shall remain intact. No cutting or removal of vegetation below 3 feet in height (excluding lawns) except for the allowable footpath. Stumps, roots, and rocks must remain intact in and on the ground.
- Pesticide or herbicide applications must be by a licensed applicator only.
- Low phosphorus, slow release nitrogen fertilizer may be used for the area that is beyond 25 feet from the reference line. No fertilizer, except limestone, shall be used between the reference line and 25 feet.

limits the expansion and storage of toxins such as salt and sand.

The diagram below was developed to accompany the above setback chart. The diagram shows the waterfront, natural woodland, and protection shoreland buffer areas and what they will generally have for plant life within them.



This setback regulations chart and the diagram should be a standard requirement for new developers coming into the area. They should be referenced or incorporated into the zoning ordinance as well as the site plan regulations. Having new developers abide by these standards would avoid new buildings from crowding the low order streams. By also having developers follow the new standards from the start, and having the charts available with town guidelines, it eliminates more possibilities of confusion or error.

If the Town of Raymond chooses to design their own buffer guidelines and set back measurements it should be done so that it still reflects the state's set standards. The town can potentially make standards and restrictions more personalized to the land use, slope, and soil type commonly surrounding its low order streams. The distance of each area can also be adjusted.

Future Steps

Adoption of this plan and the newly formed ordinance will be the biggest way for the town to support the buffer set back requirements and protect the town’s streams and water ways from future damage and new development coming into the town. The new zoning ordinance should be applied to new land use changes. Current land uses and property owner

The town’s site plan regulations should include the data on each protective zone and the restrictions that exist for each zone. The data included should have the length of each zone, preferably zone charts, and detailed descriptions of restrictions and limits on impervious surfaces.

Conclusion

The recommended model ordinance developed by the Technical/Advisory Committee addresses these concerns. It protects the buffering capacity that undisturbed shoreland provide while also allowing landowners to utilize their property, thus helping to maintain its value for the landowner and the community at large.

Appendix A: Maps